how to reach the caecum is responsible for many deaths that could otherwise be avoided. In the matter of drainage I firmly believe that it is better to drain a case that is questionable than to close one up that subsequently develops an abscess. In addition to the sites of drainage which Sproat uses, I invariably place a cigarette drain down into the right pelvis; this is particularly necessary where you are using the Fowler position following operation. Another very important point in the handling of these cases is the saturation of the patient's system with fluid. As has been so well shown by Crile, this can best be accomplished through hypodermoclysis. My routine is to give the patient at least 3000 cc. during the first twenty-four hours—he is kept well morphinized and in a Fowler position. I use practically the same incision which Sproat describes; occasionally in clean cases in children or young males I will use the muscle-splitting incision of McBurney.

Robert R. Craig, M. D., (Tonopah, Nev.)—More than half of my acute appendicitis cases are ruptured. I have never operated without removing the appendix, and so far have had no catastrophies traceable to this procedure. By gentle, careful technique most appendices can be located, isolated and removed without evisceration or contamination of the whole abdominal cavity. I see no advantage in the right rectus abdominis incision and often the disadvantage of opening into the free peritoneal cavity, instead of into the main objective, for one can to better advantage explore the abscess from the inside than from the outside. I prefer the right external incision, as far out as possible, sometimes opening directly into the abscess extraperitoneally. Through this incision one follows the leads, edematous peritoneum, omentum, and inflamed bowel, and by palpation reaches the abscess cavity, which is evacuated; and explored with the gloved finger, the appendix located and isolated with as little disturbance of protective walls as possible; often when the caecum is adherent the appendix is removed without drawing it into the incision. Three drains are used, one at least a cigarette or rubber tube, placing one in the pelvis, one to the stump of the appendix, and one high to upper limit of infection among the coils of inflamed intestine and omentum. If any part of the appendix lies without the abscess wall, the abscess is usually a very small one and at no point adherent to anterior parietes.

Dr. Sproat (closing)—I believe that conservatism, in not breaking down protective barriers to remove the appendix in acute cases where such barriers exist, is coming into more general usage. The more virulent the infection the greater the need for the absence of tissue trauma, and breaking down natural protective walls. In the majority of these cases the appendix extends outside of these walls, and they are notoriously difficult of removal, even with the greatest possible care.

Lower and Jones of Cleveland, in their paper read before the Section on Surgery, general and abdominal, at the American Medical Association meeting last June, state as follows: "The high operative mortality in cases of acute appendicitis and the postoperative morbidity in cases of chronic appendicitis are, in our opinion, due in large measure to the common belief that in each case the only proper procedure is removal of the appendix." And again, "In acute appendicitis we would emphasize our own adherence to the procedures outlined, and to Crile's principle of confining the primary operative procedure to incision and drainage only; if the appendix is not readily accessible, the removal of the appendix and such other exploration as may be necessary being deferred until the acute state is past."

Since this paper was read, I operated upon a patient with an acute fulminating infection which caused rupture and abscess in thirty-six hours of onset, and within twenty-three days the incision had closed and he had left the hospital. From past experiences with removal, convalescence, I am sure, would have been a stormy one had this been done.

KIDNEY AND URETERAL STONE SURGERY*

By HERMAN L. KRETSCHMER, M. D., Chicago

In presenting for your consideration the problems of kidney stone surgery, I have thought it advisable not to dwell at length on the technical side of the subject nor to burden you with the reading of statistics, but to present some of the difficulties and some of the problems encountered in our everyday work.

It is also advisable, when considering this subject, to include stones in the ureter, since some of the problems of diagnosis and many of the clinical symptoms are present both in kidney stone and stone in the ureter to such an extent that at first an absolute differentiation between them from the clinical history alone is not possible.

At one time it was the opinion that kidney stones, as well as renal infections, were rare in women; but recent intensive studies of this subject have completely disproved this. Not only do kidney and ureteral stones occur in women, but they occur much more frequently than has hitherto been supposed. This applies also to the frequency of occurrence of renal infections. In fact, if certain renal infections which occur only in women are considered—such as pyelitis during and after pregnancy, the greater number of cases of pyelitis of infancy among girl babies as compared with boy babies, the frequency of kidney infections either immediately or remotely after gynecological operations, as well as these infections associated with pathological conditions of the female pelvic organs, one may safely say that kidney infections occur much more frequently in women than in men.

Kidney stone, according to custom, is generally associated with a so-called classical history of renal colic. Not infrequently, however, kidney stones run a silent course. At times there may be no subjective symptoms suggestive of renal stone; again, the only manifestation may be the presence of pus in the urine, and this may be very slight or even absent. As examples of cases in which kidney stones were found, though not suspected, I would like to mention briefly just a few instances. One of our patients complained of frequency of urination, which, because of his age, he attributed to his prostate gland. The final diagnosis was carcinoma of the colon, which necessitated a colostomy for obstruction. Roentgen-ray examination revealed a large stone in the kidney.

Another patient, suffering from tabes for many years, had urinary incontinence. Roentgen-ray examination showed a large solitary kidney stone.

A young woman had the symptoms and signs of renal tuberculosis, the diagnosis being substantiated by means of the cystoscope and the ureteral catheter. A routine Roentgen-ray examination revealed a stone in the tuberculous kidney.

A man of 70 came to the office to have one of his periodical recurring attacks of cystitis treated by vesical irrigations, as had been his custom for many years. Routine Roentgen-ray examination showed

multiple stones in the kidney. Many more cases of this character could be cited, but I believe these few amply illustrate just what is meant by silent stones. No doubt there are many cases of this kind overlooked.

Stones having their origin in the kidney may have one of the following four terminations:

1. The stone may remain in one of the kidney calyces or in the pelvis.

2. The stone may enter the ureter, and in its course become lodged. This usually occurs with predilection at one of the physiological constrictions of the ureter.

3. The stone may pass from the ureter into the bladder, where it may remain and become the nucleus of a bladder stone. If a careful history is elicited in cases of vesical calculi, it is highly probable, in a certain percentage of cases, to obtain a history of a previous attack of renal colic. This may have occurred many years before, so that the patient may have quite forgotten it, unless his attention is specifically called to the fact.

4. The stone may be voided by the patient.

The present high plane which has been attained in the surgical treatment of renal calculi is a more or less direct outgrowth of the accurate methods of diagnosis which are at our command. Briefly, they are: The Roentgen ray, the cystoscope and ureteral catheter, the shadowgraph catheter and pyelography, and functional kidney tests.

Undoubtedly, the single factor which has contributed most to the diagnosis of kidney and ureteral calculi is the Roentgen ray. Its field of usefulness in this work is enriched by the simultaneous employment of the Roentgen ray and the cystoscope, made possible by the introduction of the shadowgraph catheter and pyelography.

While it may be possible, in a large number of cases, to make a diagnosis by means of the Roentgen ray alone, there will always remain a certain number of cases in which pyelography, or the shadowgraph catheter, or both, must be employed. For example, in cases of stone occurring in the renal pelvis, no positive diagnosis can be made without the employment of one or both of these additional aids. The value of the shadowgraph catheter in the diagnosis of stone in the renal pelvis and other conditions has been previously reported.

Not only is the Roentgen ray of value in the diagnosis of calculi, but it is of inestimable importance in watching the progress of a calculus through the ureter. Another example in which a combination of methods is of value is illustrated in cases in which a stone in the renal pelvis or ureter does not show plainly in the roentgenogram. If a solution of collargol is injected into the pelvis or ureter and a second picture is taken, the stone will appear very distinctly on the plate.

In employing the Roentgen ray, it is of prime importance to remember that the exposure should include both kidneys and both ureters. The value of this procedure is apparent when the frequency of bilateral calculi is recalled, as well as the possibility of the presence of stone in one kidney, and the occurrence of one or more stones in the ureter

of the same or opposite side. The importance of this procedure is also apparent in cases in which a nephrectomy has been performed for stone, and the patient afterward returns with a stone in the remaining kidney. Under such untoward circumstances it is of more than academic interest to ascertain whether the stone was present before the first operation or whether it formed subsequently.

LIMITATIONS OF THE ROENTGEN RAY

Perhaps the greatest source of error is due to failure to interpret the shadows correctly, and not to failure to demonstrate shadows in the Roentgen plate. As is well known, there are many shadow-producing bodies located outside the urinary tract, which are often interpreted as due to lithiasis. This occurs most frequently in cases of suspected ureteral calculi. The frequency with which patients are sent to a hospital with the diagnosis of stone in the ureter and in which the patient or his physician proudly points to a small shadow as being the offending stone, is known to all. The occurrence of these shadows should always be borne in mind, and when there is any doubt as to their nature and location, the shadowgraph catheter should be employed. Although in a large number of cases this procedure is of assistance, there remain, unfortunately, a small number of cases in which even this method fails to give the desired information. It is my opinion that this small percentage can be reduced still further by resorting to a procedure, previously described, in which a double exposure upon a single plate is made with a shift in the tube.

The routine use of the Roentgen ray after operation for renal stone has not become an established procedure, although it deserves to be. While this procedure will often put the surgeon in the embarrassing position of showing that he has failed to remove all the stones, it will, on the other hand, yield data which will have a direct bearing on the percentage of recurrences, a subject which at present is deserving of closer study than it has received in the past. I can recall several instances in which there is no doubt that all the stones were not removed at the primary operation, but nevertheless were classified under recurrences, thereby belittling the operation.

Not infrequently the Roentgen ray fails to yield the desired information. This may be due to the following factors:

1. The inherent limitations of any diagnostic measure.

2. Errors in the Roentgen technique due purely to the roentgenologist.

3. The calculus may be situated in so peculiar a manner that it is overlooked when the plate is read. This occurs when a small calculus is situated behind the rib, over a transverse process, over the ilium or when the plate is so placed that the stone comes just at the edge of the plate.

4. On account of the chemical nature of the stone, its demonstration by means of the Roentgen ray is impossible.

5. The stone may have been passed.

CYSTOSCOPY AND URETERAL CATHETERIZATION

While these two diagnostic aids cannot establish a positive diagnosis in each case of renal or ureteral calculus, they can, in a definite number of cases, yield information from which a diagnosis may be made or surmised. By their employment, it is possible in nearly all cases to locate the source of the pathological elements found in the urine, such as blood or pus. In renal stone associated with profuse hemorrhage, the origin of the blood may be determined by means of cystoscopy and ureteral catheterization; and also in descending ureteral stone associated with colic, changes may often be seen about the ureteral orifice of the corresponding side. Mention should be made here of the wax-tipped catheter. If positive information is obtained by its use, one may venture the diagnosis of stone; on the other hand, if the result of this examination is negative, the presence of stone should not be excluded.

FUNCTIONAL TESTS

After the diagnosis of stone has been made and the treatment outlined, the condition of the opposite kidney should engage our attention, and especially whether the kidney is present or absent. This important point deserves due consideration in each case, no matter how simple the contemplated operative procedure may be. Not infrequently a simple operation is decided upon, but because of complications arising in its course the removal of the kidney is necessary. In such an instance, if the presence of the opposite kidney has previously been determined and its functional capacity estimated, it can readily be seen how decidedly comforting to the operator this must be.

Of the various functional tests which have been advised, the phenolsulphonepthalein test has been most frequently used, and it has answered my purpose very well. Many objections have been advanced against complete reliance upon dye tests. One should not rely altogether upon the result of the dye test, but should include careful examination of the urine, both chemically and bacteriologically.

TREATMENT

Before taking up the treatment of kidney stones, I shall briefly discuss the treatment of stones in the ureter.

In a general way, the treatment of ureteral calculi passed through three stages: The first stage may be represented by the period immediately after the introduction of the Roentgen rays. At that time many of the now well-recognized extraureteral shadow-producing bodies were erroneously diagnosed as calculi, and patients were unnecessarily operated upon. The second stage may be represented by the period immediately following the introduction of the shadowgraph catheter, by means of which more accurate diagnoses were made and the number of unnecessary operations decidedly reduced. The consensus of opinion at that time was that the treatment of ureteral calculi was surgical, and the operation employed was the extraperitoneal ureterotomy. The third period may be represented by our present-day views, and is characterized by the swing of the pendulum in the opposite direction, so that at the present time the keynote is conservatism. In other words, one resorts to operation only after a prolonged, careful and conscientious use of the non-operative measures fails to accomplish removal of the stone.

These non-operative measures consist in the use of intravesical manipulations with the cystoscope. Briefly considered they are: First, dilatation of the ureteral orifice, either with a catheter or with a ureteral dilator, in order to stretch the ureteral orifice so that the stone may be allowed to pass. Where this fails and sufficient dilatation cannot be obtained, the ureteral orifice may be enlarged by slitting it with the scissors. In cases in which the stone is smaller than the ureteral orifice and situated high above the bladder in the ureter, the stone may be dislodged by the ureteral catheter. This may be followed by intraureteral injections of local anesthesia, succeeded by the injection of oil. To aid in dilating the ureter, injections into it of a solution of papaverin have been advised.

Experience has proved that by far the largest number of stones in the ureter can be handled in this way. In the remaining small number which do not respond to repeated applications of this form of treatment, advising an open operation may be justifiable.

INDICATIONS FOR OPERATION

1. Cases in which there is a vital indication to operate. Under this head, one may consider cases of anuria, acute pyelonephritic infection, profuse hemorrhage, and conditions of retention which sooner or later lead to atrophy of the kidney.

2. Cases in which operation must be advised, but in which there is no immediate danger as regards the life of the patient or the function of the kidney. To this group belong the cases associated with chronic pyelitis, repeated attacks of colic without the passage of stone, pain or discomfort in the kidney area and the presence of stone in the ureter, which do not respond to non-operative treatment.

3. Cases in which intervention is unnecessary. In this group, cases may be considered which can be treated medically. Briefly, these are cases characterized by repeated attacks of colic associated with the passage of small stones, in which the urine is not infected and in which the Roentgen ray does not reveal large stones.

The three operative procedures in the surgical removal of kidney stone are pyelotomy, nephrotomy, and nephrectomy.

Pyelotomy, in cases in which this procedure is suitable, is simple and safe, involving little or no hemorrhage, and its great advantage over other operations is that there is no mutilation of kidney tissue, which occurs to a certain extent when nephrotomy is carried out. Pyelotomy, furthermore, prevents the occurrence of hemorrhage from the kidney into the renal pelvis, which often results in the bladder becoming distended with large blood-clots, so that the patient suffers a great deal of pain, and considerable inconvenience is experienced in freeing the bladder from these clots. The essentials for success in pyelotomy are:

1. In selection of cases to be guided by the re-

sults of the Roentgen ray and possibly by the pyelographic findings.

2. The limitations of its use to pelvic stones.

3. Its employment in cases in which there is no infection, or at best only an infection of mild degree.

4. The deliverance of the kidney.

5. The avoidance of unnecessary trauma to the pelvis.

6. The prevention of injury to the blood supply of the kidney pelvis.

Before incising the pelvis, the peripelvic fat should be carefully separated. Occasionally an accessory pelvic vessel may be present, and unless this is recognized and avoided, the patient may have a certain amount of hemorrhage. Great care should be used in performing pyelotomy so as not to tear the renal pelvis, not only because of the danger of hemorrhage, but also because large and irregular tears of the renal pelvis have been followed by persistent sinus formation. On account of the more or less limited field of operation, it is particularly desirable, before closing the incision in the pelvis, to be sure that the stone removed is intact and that no fragments have been left behind. After the stone or stones have been removed, the incision is closed with fine catgut, and then the peripelvic fat is sutured over the incision with one or two catgut sutures.

Nephrolithotomy—In cases in which the stone is too large to be removed through the pyelotomy incision or in which the stones extend into the calyces, branching in various directions, and in instances in which the pedicle is very short and in which there is a good deal of perirenal inflammation, and the kidney cannot therefore be delivered, nephrolithotomy should be done. There are instances in which a pyelotomy is the operation decided upon, having determined upon this procedure from the roentgenogram, but one or several of the aforementioned conditions being found, nephrolithotomy is the only course open. At times it may happen that a calculus must be removed with the kidney remaining in situ.

After the kidney has been delivered into the wound, it should be carefully palpated for the presence of stone; that is, the stone should be definitely located before cutting into the kidney. This may not always be possible when the calculi are very small; yet, when possible, it should always be done. Palpation of the renal pelvis may be carried out at the same time.

In cases in which the stone is seen on the roentgenogram but cannot be felt, some surgeons are in the habit of needling the kidney. This procedure is advocated by some, but condemned by many, chiefly for the reason that if a hard nodule is felt and is a calculus, it must be cut down upon anyway. If nothing is felt by needling, no one would be satisfied by the limited information obtained in this way; hence, an exploratory incision must be resorted to by all means.

If the calculus can be felt in the substance of the kidney, it should be exposed by incision, either on the convex border of the kidney, or, if the stone is near the anterior or posterior surface of the kidney, it may be cut down upon directly.

The nephrotomy incision is usually made in the convex border a little nearer the posterior portion of the convexity than the anterior, since there is less danger of injuring the vessels. After the incision has been made, the interior may be examined with the finger, or the calculus may be directly removed with the aid of the forceps. The stone must be carefully examined to ascertain whether or not it is complete, whether or not facets are present, in order that calculi may not be overlooked.

The further treatment of the nephrotomy wound will depend upon several factors, the chief of which is infection. When infection is present, it is often advisable to insert a tube for drainage, although this procedure has been criticized because of the danger of hemorrhage which may result.

Hemorrhage is one of the more important complications following nephrotomy, and has often proved so serious that a secondary nephrectomy was necessary in order to save the life of the patient. When the hemorrhage occurs at the time of nephrotomy, it can usually be controlled by grasping the pedicle when an inspection of the field is effected. Occasionally a spurting artery is seen that can be caught with the forceps. Often when the oozing appears to be general, it may be controlled by hot pads. As a rule, the sutures which close a nephrotomy incision suffice to control the bleeding.

Continued post-operative hemorrhage renders the operator absolutely helpless. As previously mentioned, the bleeding continues, the hemoglobin goes down steadily, the patient's mucous membranes become pale; hence, a nephrectomy must be done to save the life of the patient. Under these untoward circumstances, one always feels more comfortable if the status of the remaining kidney has been definitely determined before operation.

COMPLICATIONS FOLLOWING NEPHROTOMY

Urinary Sinus—The urinary sinus usually closes in a few days or a week, but occasionally the urine continues to be discharged for three weeks. If, however, a sinus persists for a longer period, closing it by passing a ureteral catheter and allowing the catheter to remain *in situ* may be attempted. However, if ureteral catheter draining fails to give relief, some exploratory operative procedure should be done to determine the reason for the persistence of the sinus.

Suppurating Sinus—The continued discharge of pus from the renal sinus should at once direct our attention to the fact that a suppurating process is still going on within the kidney. In attempting to close the sinus by local treatment, possible organic factors for keeping the sinus open should not be overlooked; therefore, local treatment should not be continued too long. As a rule, the reason for the persistence of a sinus remaining open can be found, and not infrequently this is due to a calculus which has formed after the operation, or has been overlooked at the time of the operation, as well as due to a sponge.

Nephrectomy—Primary nephrectomy for stone is

less frequently done than either of the two previously mentioned operations. As a primary operation it is resorted to in cases of stone associated with severe infection, tumor, or tuberculosis. In these cases, results are very much better following nephrectomy than nephrotomy, provided, of course, that the other kidney is present and functioning as discussed above. Secondary nephrectomy must be resorted to in cases of persistent fistula after other operative measures have failed to effect a cure; in cases of recurrence of stone, persistent infection of the kidney after the primary removal of calculi, and for the relief of uncontrolled secondary hemorrhage following nephrotomy or pyelotomy.

Nephrectomy is the most serious of the operative measures for the relief of stone, but the ultimate result, as regards recurrences, is better than with the other two operative procedures.

Hemorrhage is one of the most serious complications of nephrectomy. It usually occurs after the kidney has been cut from its pedicle and the clamp removed, but it may be due to other causes, such as failure to include the vessels in the ligature, placing the second ligature over the first, which may render the first one ineffective, and cutting the ligature when the kidney is removed. Slight oozing can usually be controlled with hot pads, but large hemorrhages are difficult to manage, since the wound rapidly fills with blood so that one cannot see. When hemorrhage occurs, the clots should be wiped out with hot pads and the site of the bleeding found. If this can be done, the bleeding vessel should be grasped with a pair of forceps and ligated. If the bleeding point cannot be seen, grasping the pedicle and exercising firm pressure with the fingers may be successful. This procedure will often allow the clots to be removed; thereby time for examination is gained and also knowledge just where the clamp should be applied. In instances where the operator attempts to stop profuse hemorrhage, injuries to the bowel by means of the clamp are prone to occur. At times the hemorrhage occurs from an accessory vessel; and, although this may be profuse, it never reaches the same proportions as does a hemorrhage from the pedicle. Bleeding may also occur from the vena cava, as a result of direct injury during operation.

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Neuro-arthropathies: A Consideration of the Etiology and General Characteristics—It is the belief of Herman B. Phillips and Charles Rosenheck, New York (Journal A. M. A., January 5, 1924), that neuro-arthropathies caused by peripheral nerve disease or injury or other factors not definitely understood may occur with more frequency than is usually believed. These neuro-arthropathies are possibly misinterpreted, on account of the absence of demonstrable disease of the central nervous system. In the wake of such misinterpretation, extensive joint operations may be performed unnecessarily, as in one case cited. The possibility of neuro-arthropathy should always be considered in obsoure or ill-defined joint manifestations, even in the absence of cord disease. The etiology may be found in disturbances of the peripheral neural apparatus or other hitherto unknown factors.

JUSTIFICATION FOR STERILIZATION BY EITHER SURGICAL OR RADIOLOGICAL METHODS

By REX DUNCAN, M. D., Los Angeles, California

The literature is abundant with most excellent articles dealing with the causes and treatment of sterility, but much less of scientific merit has been published pertaining to the justification for sterilization. Indication for sterilization broadly may be included under two heads. First, medical or those in which, because of some pathological condition in the woman, it is necessary to prevent pregnancy that her life may not be endangered. In advanced pulmonary tuberculosis, nephritis, diabetes, advanced cardiac lesions or other constitutional disturbances which would render pregnancy dangerous to the life of the woman, sterilization is indicated. In uterine cancer, fibroids, certain inflammatory conditions of the pelvic organ and other conditions in which sterilization would necessarily follow, appropriate treatment is undoubtedly justified. In women with deformed pelves or other conditions where delivery would require cesarian section or other dangerous operative procedure, it is a question to be determined by the patient, family, and physician. Statistical studies show quite clearly that pregnancy favors the recurrence of malignant diseases in breast cancer and malignant diseases of the genital organs, and while these conditions quite commonly occur after the child-bearing period, sterilization is undoubtedly indicated. Without entering into a detailed discussion of the numerous pathological conditions in which it might be indicated, it would seem that the woman's life should receive first consideration and it is, therefore, justifiable to produce sterilization in any of those conditions in which it might be demonstrated after proper consultation that pregnancy would endanger the life of the woman.

Secondly, the justification of sterilization for social or economic reasons or from a purely eugenic standpoint are subjects in which there is a great variance of opinion and permissible of considerable discussion. The attitude regarding sterilization for social reasons is rapidly changing. Undoubtedly, it is worthy of more thought. However, further discussion will be omitted here.

It is, of course, a well-established fact that sterilization may be produced either by surgical or radiological methods. The method to be chosen necessarily depends somewhat upon the pathological conditions rendering such a measure justifiable or permissible, the numerous indications for which need not be outlined here. Sterility may be produced by a single intra-uterine application of 2500 or more millicurie hours of radium which may be given in from four to 24 hours, depending upon the quantity of radium used or by the use of X-ray treatment over the pelvis, using such technique that the ovaries will receive approximately an erythema skin dose. This may be accomplished with high voltage X-ray equipment in one or two applications totaling approximately one hour.

While radium is commonly employed in the treatment of certain pathological conditions of the pelvis without producing sterility, sterilization pro-